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(54) Title: A WINDSCREEN WIPER
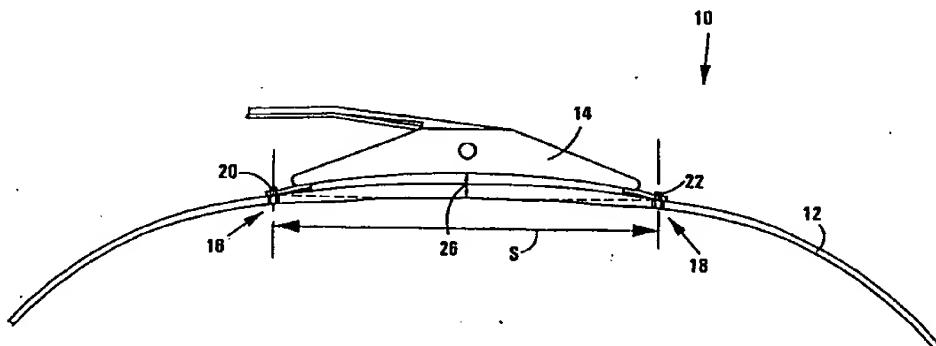
(57) Abstract

A windscreen wiper (10) includes an elongate curved backbone (12) which is of a resiliently flexible material and a force applying member (14) which is connected to the backbone at two spaced apart points (20, 22). The spacing distance S (expressed in millimetres) between the points then is between (1) $S_1 = 0.1 *L$ .... and (2) $S_2 = 0.35 *L$ .... where the length is the total length of the backbone expressed in millimetres.

A WINDSCREEN WIPER

10   This invention relates to a windscreen wiper, which is also known as a

windshield wiper.

The invention relates in particular to a windscreen wiper which has a curved

backbone and which may have a varying width and/or thickness. It will be appreciated

15   by those skilled in the art that the backbone may be in the form of a beam that is

curved in a plane or may have compound curvature. The beam will then usually have

width and thickness dimensions. The beam will also have a radius of curvature at

each point along its length.

20   When such a windscreen wiper is pressed onto a surface such as the

windscreen (or windshield) of a vehicle, the force intensity (the force per unit length)

will vary at different positions along the length of the beam. A large number of

factors affect the manner in which the force intensity distribution varies, such as:

the material from which the beam is made and the Young's modulus

25   thereof;

the length of the beam;

curvature of the beam;

curvature of the surface;

variation in any one or both of the width of the beam and the thickness

30   of the beam;

the magnitude of the force applied to the beam; and

the position, or positions, at which the force is applied.

35   The applicant has found that, with shorter beams, it is adequate to apply the force at a single point. However, with longer beams, ie beams that are longer than about 400mm it is preferable to apply the force to the beam at two spaced apart points. The applicant has further found that the degree of variation of force intensity resulting from changes in curvature of the surface and the magnitude of the force applied to the beam, in use, varies significantly depending on the spacing between the

40   points of application of the force and the ratio between the spacing distance and the total length of the beam.

        The applicant has further found that if the spacing between the points exceeds a certain limit, the windscreen wiper will not operate in an efficient manner. There

45   are two main factors which should be taken into account when determining the upper bound of the spacing between the points. Firstly, the vertical clearance between the beam and a force applying member should be taken in to account when, in use, the beam changes from straight to free form and vice versa. Secondly, longitudinal movement of the beam between the force application points should also be

50   considered, when the beam changes from straight to free form and vice versa.

        The applicant has conducted substantial analysis in this regard and believes that he has found a relationship between the spacing distance and the total length of the beam and, consequently, between the ratio of spacing distance to total length and

55   length, which provides a windscreen wiper that operates in an improved manner.

According to a first aspect of the invention there is provided a windscreen wiper which includes

an elongate curved backbone which is of a resiliently flexible material; and

60   a force applying member which is connected to the backbone at two spaced apart points

with the spacing distance S (expressed in millimetres) between the points being between

$$S_1 = 0.1 * L \ \ldots\ldots\ldots \tag{1}$$

65   and

$$S_2 = 0.35 * L \ \ldots\ldots\ldots \tag{2}$$

where the length L is the total length of the backbone expressed in millimetres.

Further according to a second aspect of the invention there is provided a

70   windscreen wiper which includes

an elongate curved backbone which is of a resiliently flexible material; and

a force applying member which is connected to the backbone at two spaced apart points

with the ratio R of spacing distance S between the points and the total length

75   L (R = S/L) being between

$$R_1 = 0.1 \ \ldots\ldots\ldots \tag{3}$$

and

$$R_2 = 0.35 \ \ldots\ldots\ldots \tag{4}$$

80

where the spacing distance S and the length L are expressed in the same units of

measure.

The preferred spacing distance S_p between the spaced apart points is about

85 $$S_p = 0.363 * L - 0.000146 * L^2 \ldots\ldots\ldots \tag{5}$$

and the preferred ratio R_p is about

$$R_p = 0.363 - 0.000146 * L \ldots\ldots\ldots \tag{6}$$

90 The force applying member may be connected to the backbone in such a manner as to permit relative longitudinal displacement between the force applying member and the backbone.

The curved backbone may have a varying width and or thickness, along its 95 length. The backbone may further have a free form curvature in a plane or may have a compound curvature (that is curved in two planes).

It will be appreciated that the force applying member normally straddles the geometric centre of the backbone. This is particularly so for a windscreen wiper that 100 is intended for use on a driver's side. However, the force applying member may be positioned off-centre for certain cases, such as on passenger side windscreens. In that way the overall performance of the wiper may be optimised.

The invention is now described, by way of example with reference to the 105 accompanying drawings. In the drawings,

Figure 1 shows schematically a windscreen wiper in accordance with the invention;

Figure 2 or Graph A illustrates the beam width at various positions along the length of the beam;

Figure 3 or Graph B illustrates the thickness of the beam at various positions along the

110　　　length of the beam;

Figure 4 or Graph C shows the beam centre-line coordinate relative to the position along the length of the beam;

Figure 5 or Graph D illustrates the typical clearance required for the beam as a function of spacing distance S; and

115　　　Figure 6 or Graph E illustrates the typical amount of longitudinal movement between the beam and the pin when the beam changes shape from curved to straight and vice-versa.

The windscreen wiper 10 includes a backbone 12 which is in the form of a

120　　　beam. The beam is made from spring steel having a Young's modulus of 205GPa. The length of the beam is 700mm. The beam tapers both in width and thickness from its centre toward its free ends or tips as shown in Graph A and Graph B respectively. Graph A illustrates the beam width (in millimetres) at various positions along the length of the beam, which is also measured in millimetres. Graph B illustrates the

125　　　thickness of the beam (in millimetres) at various positions along the length of the beam which is also measured in millimetres.

The beam is curved longitudinally, in a plane, with a predetermined radius of curvature at every point along its length. Graph C shows the beam centre-line

130　　　coordinate relative to the position along the length of the beam (in millimetres).

A force applying member 14 is connected to the beam 12 at two spaced apart points 16 and 18, with a spacing distance S between the points. At the point 16, the force applying member 14 is connected to the beam 12 by means of a pin 20 which

135   is pivotally located in a complementary hole in the beam 12 which does not permit relative longitudinal movement between the beam 12 and the force applying member 14. At the other point 18, the force applying member 14 is connected to the beam 12 by means of a pin 22 which is received in a longitudinal slot 24 in the beam 12 so that relative longitudinal and pivotal movement between the pin 22 and beam 12 is

140   permitted.

It will be appreciated that there needs to be clearance between the force applying member 14 and a line between the points 16 and 18, indicated at 26, in which the section of the beam 12 between the points 16 and 18 can move when the

145   beam changes shape from curved to straight and vice-versa.

Graph D illustrates the typical clearance 26 required for the beam 12 described above as a function of spacing distance S and Graph E illustrates the typical amount of longitudinal movement between the beam 12 and the pin 22 when the beam 12

150   changes shape from curved to straight and vice-versa.

The spacing S is 150mm. In this case, the ratio R of spacing distance S between the points 16 and 18 and the total length L (R = S/L) is therefore 0,214.

155

CLAIMS:

1.   A windscreen wiper which includes

            an elongate curved backbone which is of a resiliently flexible material; and

            a force applying member which is connected to the backbone at two spaced

160   apart points

            with the spacing distance S (expressed in millimetres) between the points being

between

            $S_1 = 0.1 * L$ ....   (1)

and

165          $S_2 = 0.35 * L$ ....   (2)

where the length L is the total length of the backbone expressed in millimetres.

2.   A windscreen wiper which includes

            an elongate curved backbone which is of a resiliently flexible material; and

170   a force applying member which is connected to the backbone at two spaced

apart points

            with the ratio R of spacing distance S between the points and the total length

L (R = S/L) being between

175          $R_1 = 0.1$ ....   (3)

and

            $R_2 = 0.35$ ....   (4)

where the spacing distance S and the length L are expressed in the same units of

180   measure.

3.   The windscreen wiper as claimed in Claim 1, in which the preferred spacing distance S_p between the spaced apart points is about

$$S_p = 0.363 * L - 0.000146 * L^2 \ldots\ldots\ldots \tag{5}$$

185   4.   The windscreen wiper as claimed in Claim 2, in which the preferred ratio R_p is about

$$R_p = 0.363 - 0.000146 * L \ldots\ldots\ldots \tag{6}$$

5.   The windscreen wiper as claimed in Claim 1, in which the force applying

190   member is connected to the backbone in such a manner as to permit relative longitudinal displacement between the force applying member and the backbone.

6.   The windscreen wiper as claimed in Claim 1, in which the curved backbone has a varying width and thickness, along its length.

195   7.   The windscreen wiper as claimed in Claim 1, in which the curved backbone has a constant thickness along its length.

8.   The windscreen wiper as claimed in Claim 1, in which the curved backbone has a constant width along its length.

200

9.   The windscreen wiper as claimed in Claim 1, in which the backbone has a free form curvature in a plane.

10.   The windscreen wiper as claimed in Claim 1, in which the backbone has a

205   compound curvature.

11. The windscreen wiper as claimed in Claim 1, in which the force applying member straddles the geometric centre of the backbone.

12. A windscreen wiper substantially as herein desribed with reference to the
210 accompanying drawing.

FIGURE 1

Beam Width (mm):

Position Along Length of Beam (mm):
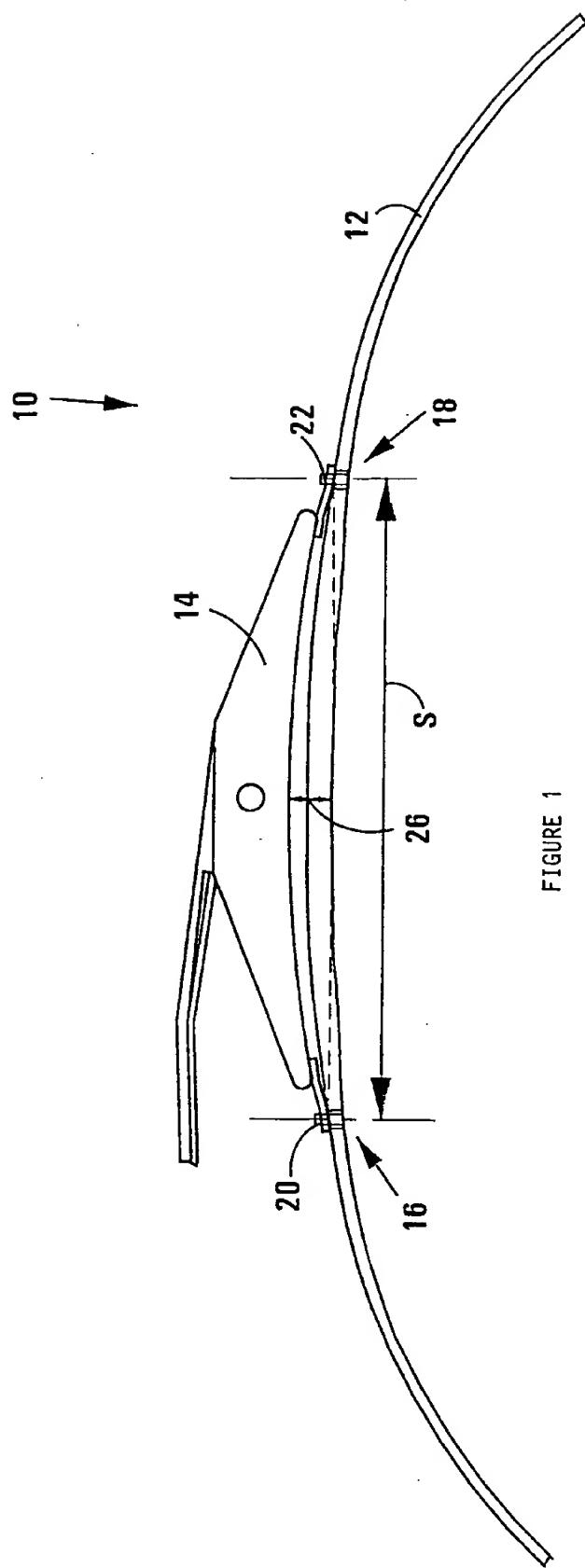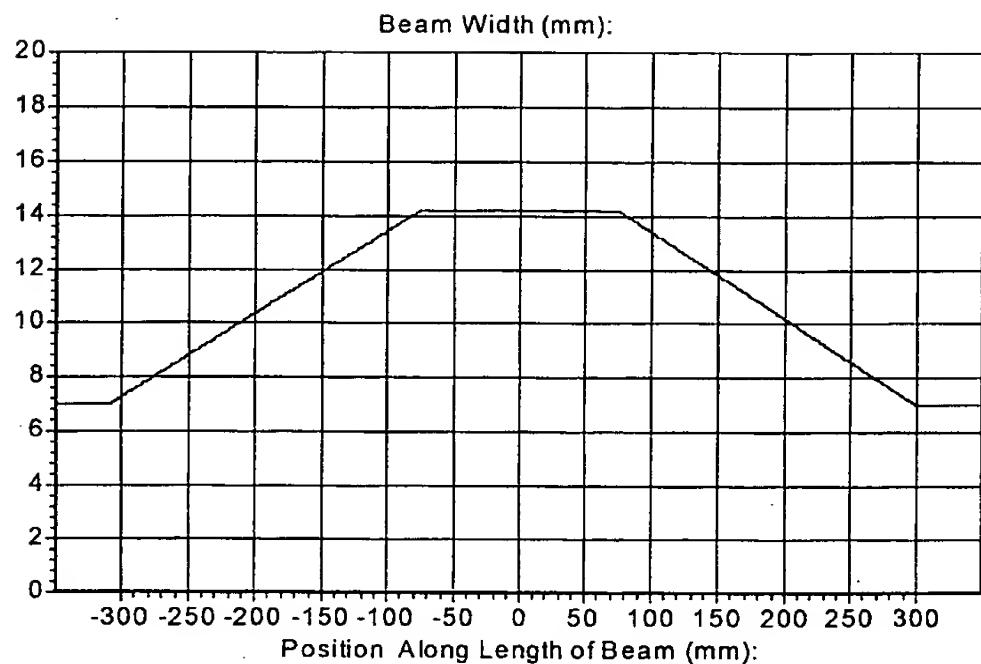
GRAPH A.

FIGURE 2

GRAPH B.

FIGURE 3

Beam Centerline Coordinates (mm):

Position Along Length of Beam (mm):
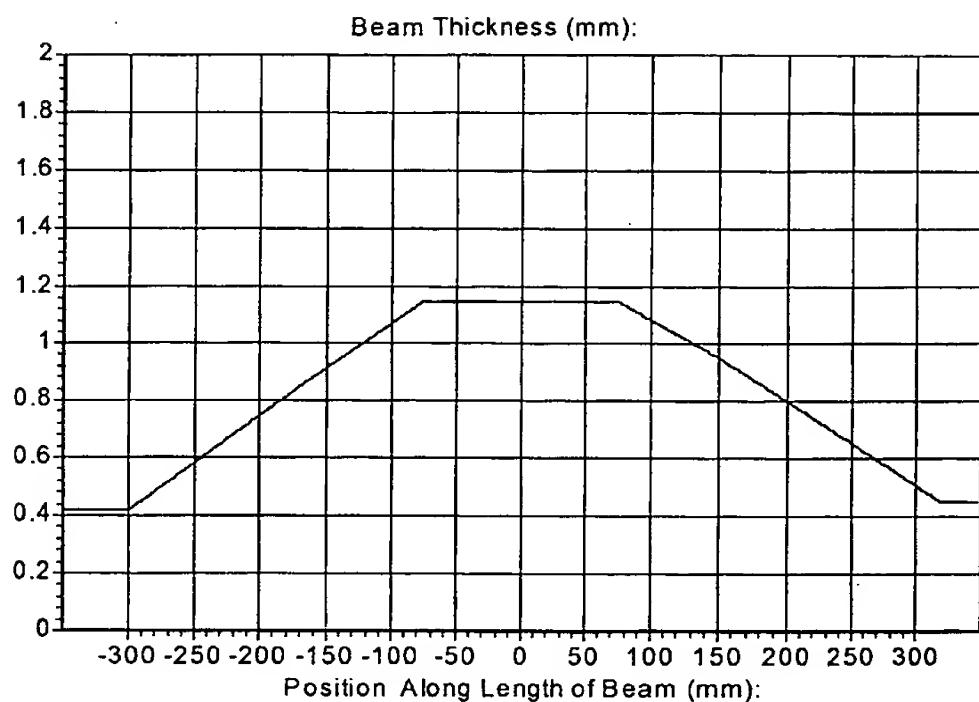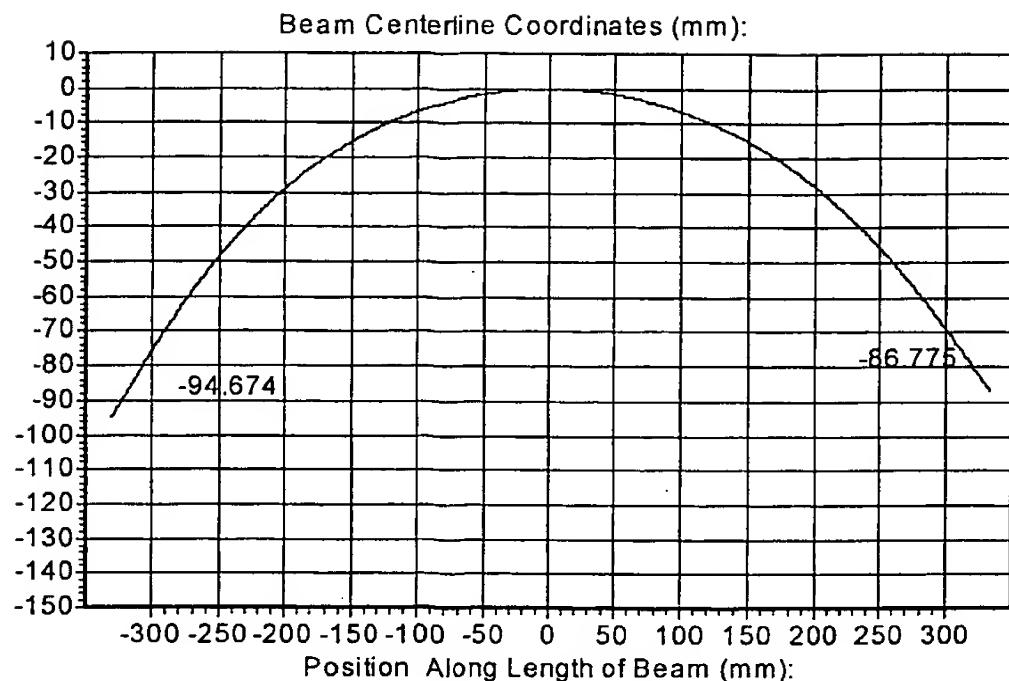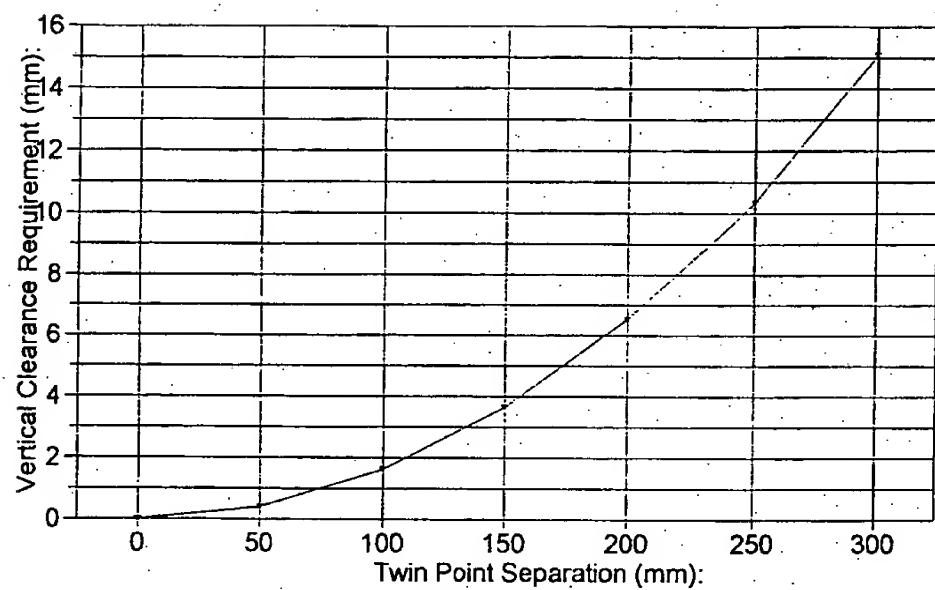
GRAPH C.

FIGURE 4
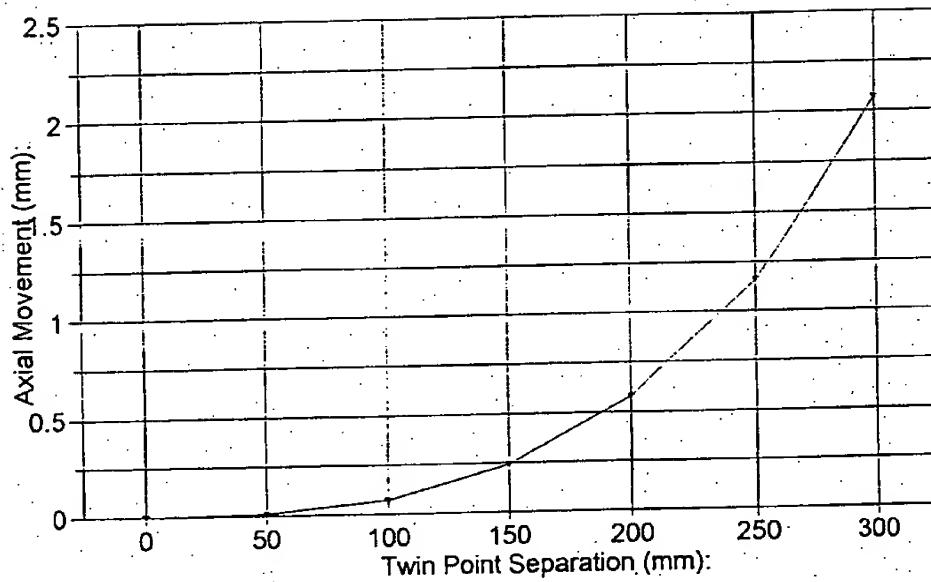
GRAPH D

FIGURE 5

GRAPH E

FIGURE 6

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7   B60S1/38   B60S1/40

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7   B60S

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	abstract; figures 1-7	6,10
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	column 3, line 3 - line 53	

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	LTD) 27 April 1994 (1994-04-27)	
A	abstract; figures 1-3	1,2,9
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	2 July 1997 (1997-07-02)	
	abstract; claim 1; figures 1-3	
	page 1, line 6 -page 3, line 3	

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[X] Further documents are listed in the continuation of box C.   [X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
14 December 1999	21/12/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Westland, P

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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